

Signetics

NE/SE5520
April 1982
Preliminary

LVDT Signal Conditioner

DEFINITION OF TERMS

Data Sheet Identification	Product Status	Definition
Preview	Formative or In Design	This data sheet contains the design specifications for product development. Specifications may change in any manner without notice.
Advance Information	Sampling or Pre-Production	This data sheet contains advance information and specifications are subject to change without notice.
Preliminary	First Production	This data sheet contains preliminary data and supplementary data will be published at a later date. Signetics reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

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LVDT SIGNAL CONDITIONER

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DESCRIPTION

The NE/SE5520 is a signal conditioning circuit for use with Linear Variable Differential Transformers (LVDT). The chip includes a low distortion amplitude stable sine wave oscillator with programmable frequency to drive the primary of the LVDT; a synchronous demodulator to convert the LVDT output amplitude and phase to position information; and an output amp to provide gain and filtering.

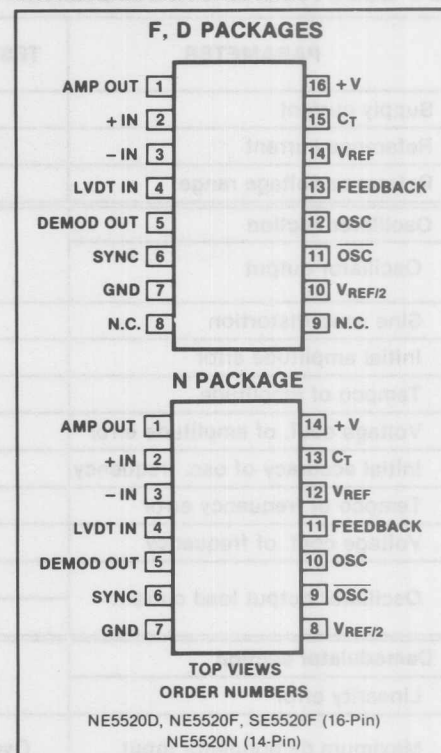
FEATURES

- Oscillator frequency: 1kHz to 20kHz
- Low distortion
- Capable of ratiometric operation
- Single supply operation 5V to 20V or dual supply $\pm 2.5V$ to $\pm 10V$
- Low power consumption

APPLICATIONS

- LVDT signal conditioning
- RVDT signal conditioning

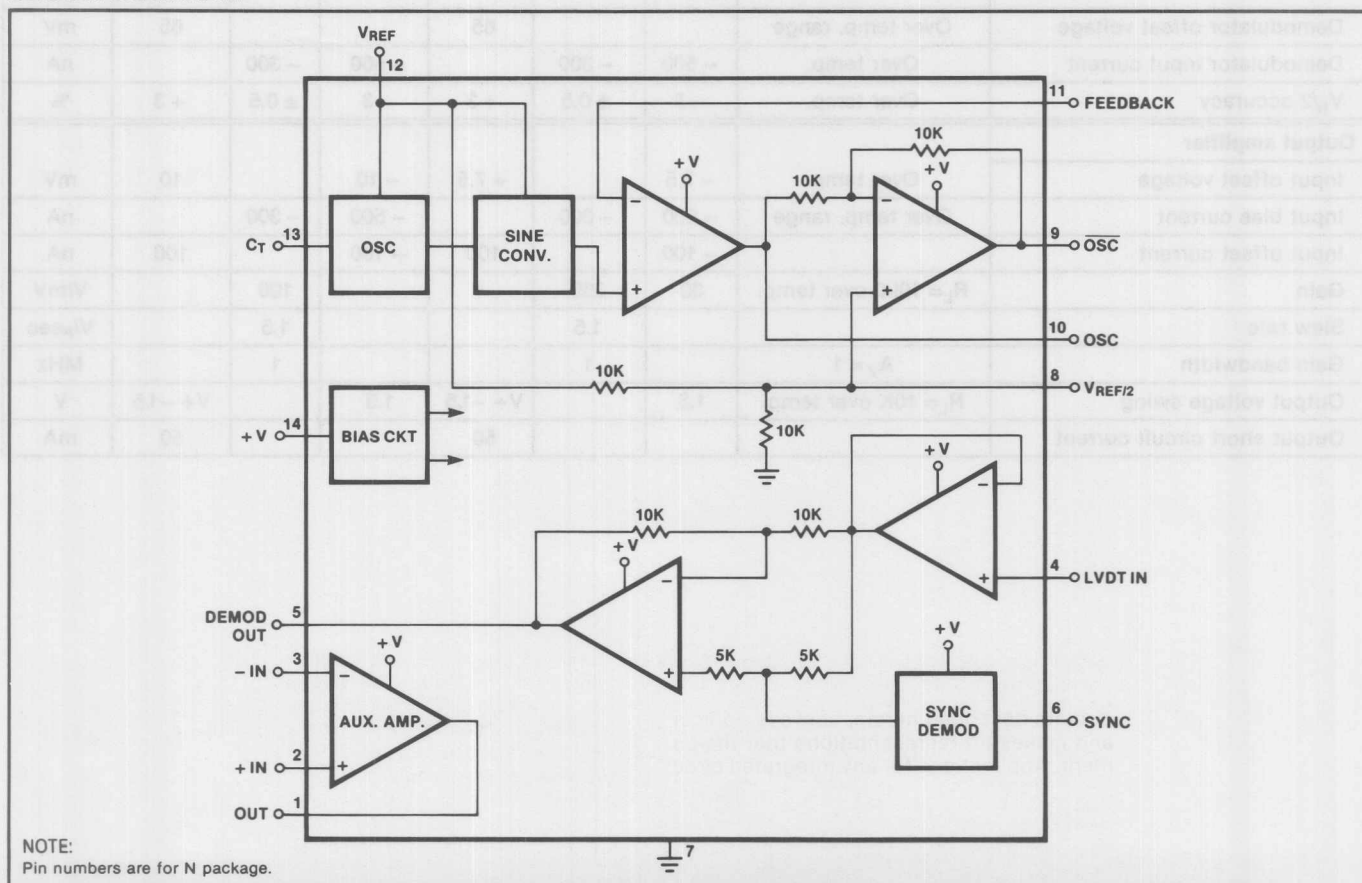
PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNIT
Supply voltage	+ 30	V
Split supply voltage	(± 15)	V
Operating temperature range		
SE5520	- 55 to + 125	°C
NE5520	0 to + 70	°C
Storage temperature range	- 65 to 150	°C

BLOCK DIAGRAM



DC ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$, $V_R = V_+ = 10\text{V}$ unless otherwise specified.

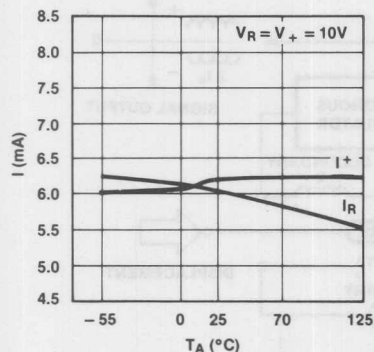
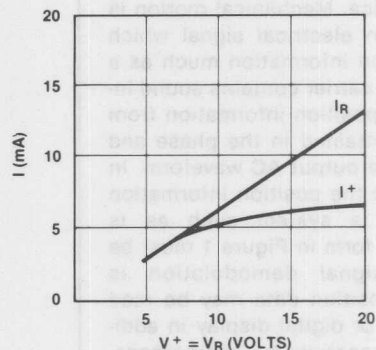
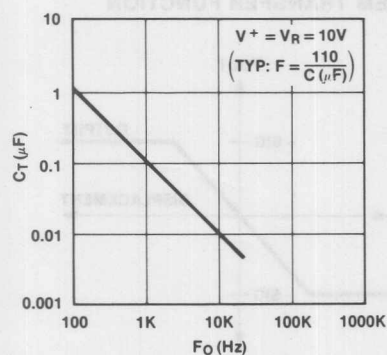
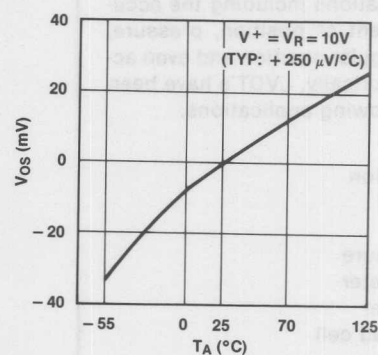
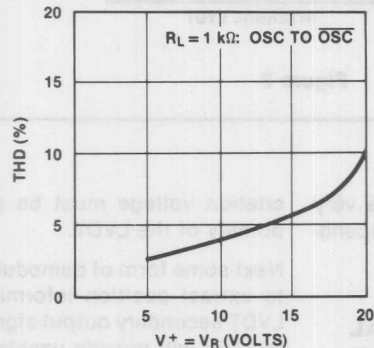
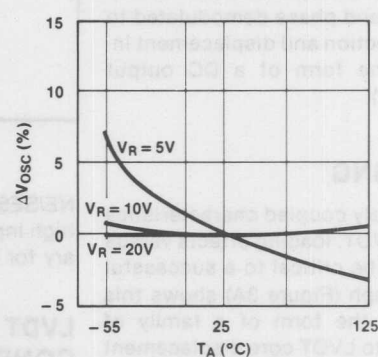
PARAMETER	TEST CONDITIONS	SE5520			NE5520			UNIT
		Min	Typ	Max	Min	Typ	Max	
Supply current	Over temp.		7.0	10		7.0	10	mA
Reference current	Over temp.		5.5	10		5.5	10	mA
Reference voltage range	Over temp.	5		V_+	5		V_+	V
Oscillator section								
Oscillator output			$\frac{V_R}{8.7}$			$\frac{V_R}{8.7}$		Vrms
Sine wave distortion			4			4		%
Initial amplitude error				3			3	%
Tempco of amplitude				0.05			0.05	%/ $^\circ\text{C}$
Voltage coef. of amplitude error				2.5			2.5	%/V
Initial accuracy of osc. frequency				20			20	%
Tempco of frequency error			0.05			0.05		%/ $^\circ\text{C}$
Voltage coef. of frequency			2.5			2.5		%/V(V_R)
Oscillator output load current			15			15		mA (rms)
	Over temp.	5			8			mA (rms)
Demodulator section								
Linearity error	Over temp.		0.05	0.1		0.05	.1	%
Maximum demodulator input	Over temp. range	$\frac{V_R}{2} - 0.4$		$\frac{V_R}{2} - 0.4$	$\frac{V_R}{2} - 0.5$		$\frac{V_R}{2} + 0.5$	V
Demodulator offset voltage	Over temp. range			65			65	mV
Demodulator input current	Over temp.	-500	-300		-500	-300		nA
$V_R/2$ accuracy	Over temp.	-3	± 0.5	+3	-3	± 0.5	+3	%
Output amplifier								
Input offset voltage	Over temp.	-7.5		+7.5	-10		10	mV
Input bias current	Over temp. range	-500	-300		-500	-300		nA
Input offset current		-100		100	-100		100	nA
Gain	$R_L = 10\text{k}\Omega$ over temp.	30	250			100		V/mV
Slew rate			1.5			1.5		V/ μsec
Gain bandwidth	$A_V = 1$		1			1		MHz
Output voltage swing	$R_L = 10\text{K}$ over temp.	1.8		$V_+ - 1.5$	1.5		$V_+ - 1.5$	V
Output short circuit current				50			50	mA

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TYPICAL PERFORMANCE CHARACTERISTICS

 I_R AND I^+ vs TEMPERATURE I_R AND I^+ vs VOLTAGE F_O vs C_T DEMODULATOR OFFSET
vs TEMPERATURE
(NORMALIZED TO 25°C)DISTORTION OF SINE WAVE
vs REFERENCE VOLTAGEOSCILLATOR AMPLITUDE VARIATION
WITH TEMPERATURE

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ALL PIN NUMBERS REFER TO N PACKAGE

INTRODUCTION

An LVDT is an electromechanical transducer which makes possible the measurement of very small motion in a structure or mechanical device. Mechanical motion is translated to an electrical signal which contains position information much as a radio frequency carrier contains sound information. The position information from the LVDT is contained in the phase and amplitude of the output AC waveform. In order to remove the position information (demodulation), a system such as is shown in block form in Figure 1 must be used. Once signal demodulation is achieved the position data may be read out on a meter or digital display in addition to being processed by microprocessor or computer. The Signetics NE5520 is a new *Monolithic LVDT Driver-Demodulator* designed to interface with most LVDT's presently being used in the industry.

Uses will range over a large number of potential applications including the accurate measurement of position, pressure, load weight, angular position and even acceleration. Historically, LVDT's have been used in the following applications:

- Load cell
- Linear motion
- Torque cell
- Vibration
- Fluid pressure
- Accelerometer
- Inclinator
- Seismic load cell

MOTION MAY BE

- Linear
- Rotary

The NE5520 provides sinusoidal drive to the Linear Variable Differential Transformer (LVDT), the output of which is buffered, rectified and phase demodulated to obtain both direction and displacement information in the form of a DC output signal (Figure 2).

LVDT LOADING

Due to the loosely coupled characteristics of the typical LVDT, loading effects versus frequency may be critical to a successful design. The graph (Figure 3A) shows this relationship in the form of a family of curves relative to LVDT core displacement for 400Hz and 2500Hz. From the curves it is obvious that the linearity and output level versus displacement is superior for an LVDT operated at 2000Hz with a very high impedance load (0.5 meg ohm). The

THE LVDT WITH SINEWAVE EXCITATION AND SYNCHRONOUS DEMODULATION

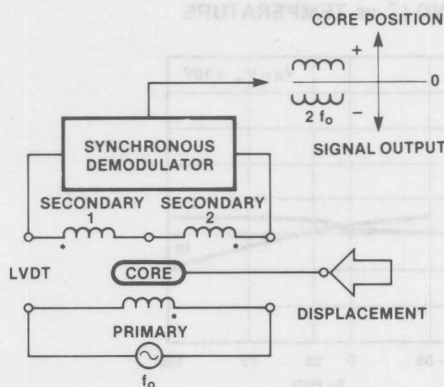


Figure 1

LVDT SYSTEM TRANSFER FUNCTION

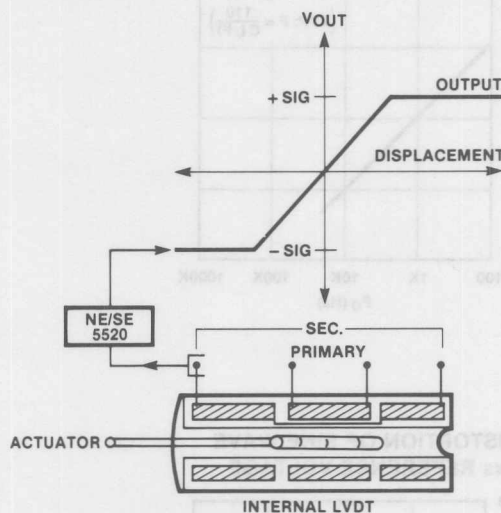


Figure 2

NE/SE5520 demodulator presents a very high input impedance to the LVDT secondary for maximum linearity. (Fig. 3B)

LVDT INTERFACING: SIGNAL CONDITIONING IS REQUIRED

In order to obtain usable information from the LVDT a series of signal conditioning circuit operations are required. First, a stable source of constant frequency ex-

citation voltage must be applied to the primary of the LVDT.

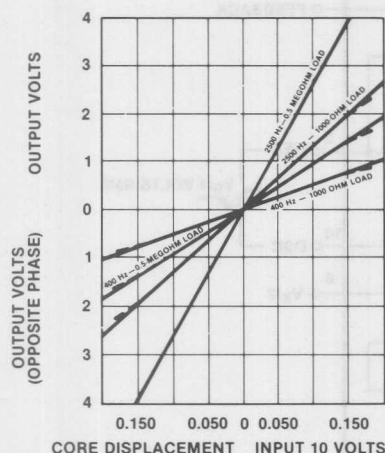
Next some form of demodulator is needed to extract position information from the LVDT secondary output signal. A full wave rectifier will provide usable amplitude information when adequately filtered, however, relative phase information is lacking. In order to obtain both phase and amplitude information synchronous demodulation is needed. This type of demodulator

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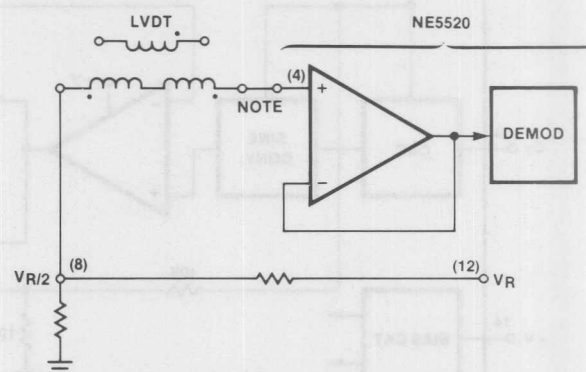
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OUTPUT CHARACTERISTICS OF A TYPICAL LVDT FOR VARIOUS LOADS AND EXCITATION FREQUENCIES



BY PERMISSION SCHAEVITZ ENGINEERING
"HANDBOOK OF MEASUREMENT AND CONTROL" BY HERCEG.

Figure 3a



NOTE: INTERNAL BUFFER AMP PROVIDES HIGH IMPEDANCE LOAD TO SECONDARY.

Figure 3b

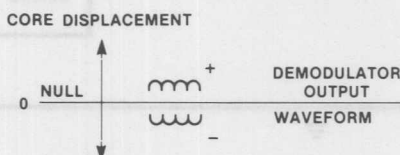


Figure 3c

exists in the Signetics NE5520. Once phase and amplitude information is obtained in the form of a polar full wave rectified signal (see Figure 3C) from the synchronous demodulator, the carrier component (actually 2nd harmonic of the carrier plus higher order spectral components) must be filtered out leaving only the true position information. This is accomplished by passing the demodulated signal through a low-pass active filter. An auxiliary operational amplifier is provided for this purpose within the NE5520, in addition to adjustable signal gain for proper full scale output (span adjustment). In addition, DC offsets are nulled by a simple offset adjustment at the auxiliary amplifier. The resulting system is a complete LVDT signal conditioner. Figure 4 shows a block diagram of the NE5520. The device

will operate in a single supply range from 5 to 25 volts DC or with split supplies of ± 5 to ± 12 volts DC. A device current, I_{CC} , of 10 milliamperes at an operating voltage of 10 volts is typical.

DESCRIPTION OF THE NE5520 (Figure 4)

The NE5520 oscillator consists of a triangle wave generator, a current source-sink circuit which switches when the capacitor voltage reaches discrete levels at $1/4$ and $3/4 V_{REF}$. The total swing being $V_{REF/2}$ volts p-p. The triangle wave is fed into a non-linear load which generates a sinusoidal waveform with low distortion. The sine wave output is then buffered by two op amps, the output of which appear on pins 9 and 10 in phase opposition. This

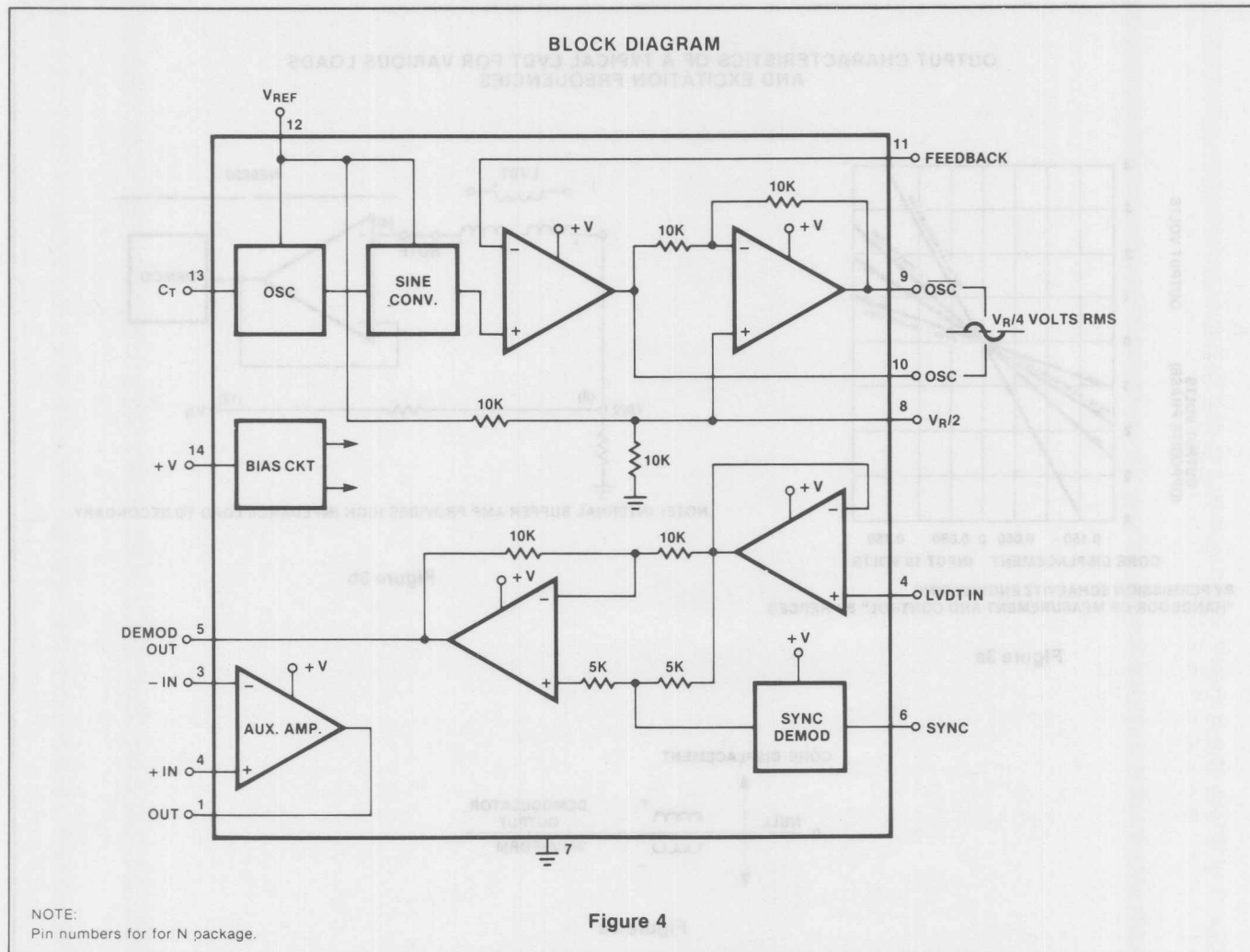
then is the excitation signal for the LVDT primary.

The second major functional portion of the NE5520 is the synchronous demodulator and this section performs full wave rectification in phase synchronism (pin 6) with the above oscillator output. In order to extract true position information, the phase relationship of the LVDT secondary must be obtained. This means that as the LVDT core passes through null an abrupt 180° phase change occurs. Once full wave rectification is accomplished, the resulting signal carrier frequency must be removed by filtering. Demodulator output appears on pin 5. This is accomplished by an active filter incorporating the auxiliary op amp (pins 1, 2, 3). The original position information then appears ripple free on pin 1 of the auxiliary amplifier.

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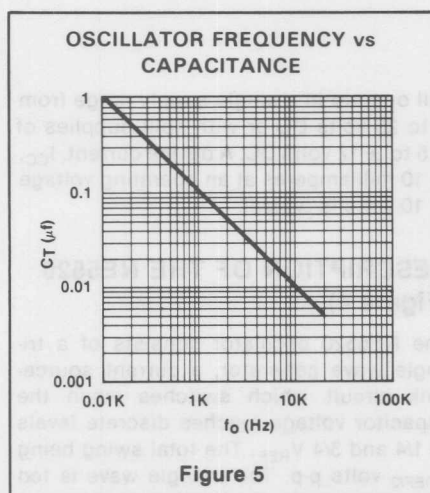


Other functions include buffer amplifier feedback in the oscillator circuit. The loop is closed with negative feedback around both amplifiers (pin 10 to 11) operating at unity gain.

The oscillator timing capacitor controls the frequency as shown in the graph, Figure 5. The frequency is related by the equation $f_{OSC} = 110/C_{\mu F}$. Absolute output frequency will vary slightly with supply voltage.

BIASING THE REFERENCE**V_{REF} (PIN 12)**

The manner in which the V_R pin is biased will effect the output voltage function of the NE5520 and consideration must be given to this in order to arrive at an optimum system design. There are two basic modes of operation involved as listed below:



- 1) Ratiometric
- 2) Fixed Reference

With the *ratiometric mode*, pin 12 (V_{REF}) is

connected to pin 14 (+V). Since V_R controls the DC common mode voltage of the demodulator and the oscillator rms output, these magnitudes will now change with supply voltage. The DC output from pin 1, using a single ground referenced supply, will be ratiometric with the supply voltage and centered within the common mode range of the output amplifier when the LVDT transducer is at null. Single or dual supply operation will be ratiometric when +V is connected to V_R .

The alternate method of biasing is the *fixed reference mode* with pin 12 (V_R) connected to a fixed reference voltage such as +10 volts and pin 14 (+V) allowed to vary with an incoming poorly regulated supply. This might occur in automotive applications where battery voltage may vary from 10 to 14 volts. However, with a fixed reference driving V_R , DC voltage at the output will not vary with supply but will vary within the common mode limits

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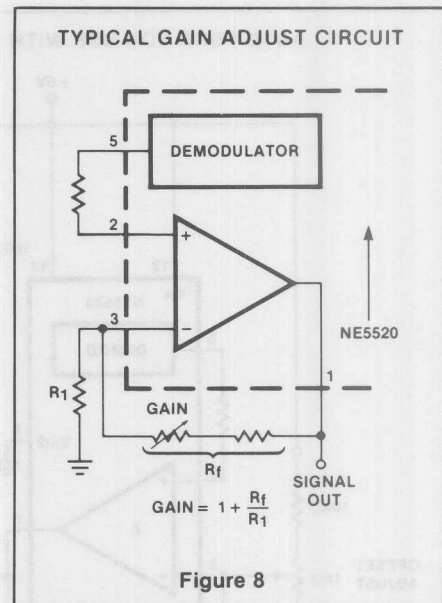
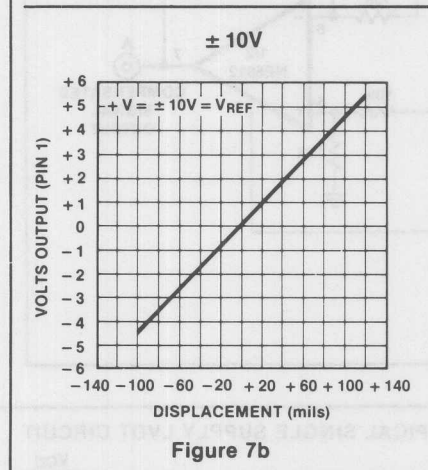
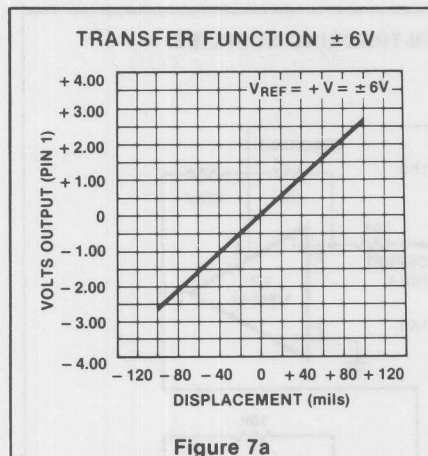
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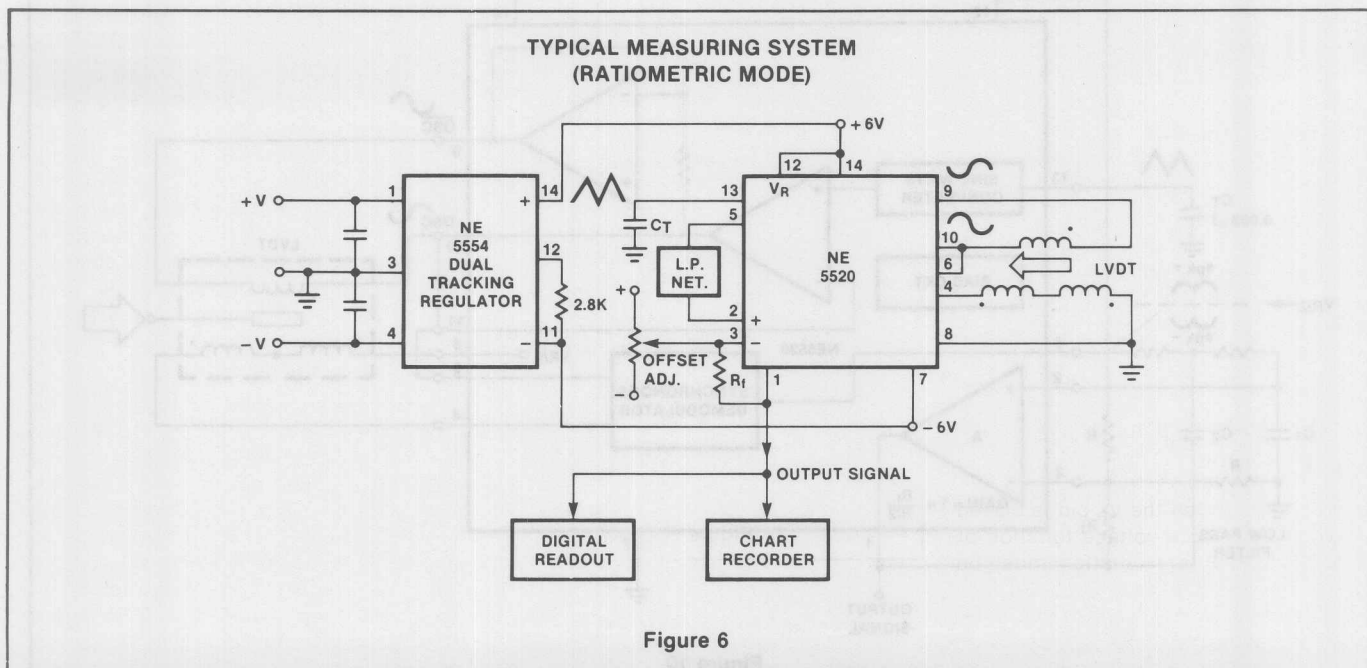
of the amplifier as the LVDT core traverses its path. Output voltage of pin 1 at LVDT null will be $V_R/2$. Thus, for the case mentioned with $V_R = 10$ volts, the null voltage will be +5 volts. The maximum linear swing would be 1.5–8.5 volts around this value. The fixed reference mode may be used with single or dual supply operation.

DUAL SUPPLY OPERATION

When connected to a typical LVDT transducer as shown in Figure 6, the NE5520 will exhibit an extremely linear transfer function. Very important to precision position measurement is the inherent repeatability of the system. The graphs in Figure 7A, B illustrate the highly linear transfer function and its repeatable accuracy with different supply voltages, in this case ± 6 and ± 10 volts. The transducer motion was over a range of ± 150 milli-inches each side of the LVDT null. Typical DC output signal is shown with an output amplifier gain of X10 in both cases. Note that linearity remains constant, however, full scale output varies with supply voltage. This is due to the increased excitor drive to the LVDT with increased supply voltage. LVDT output is a linear function of excitor amplitude on the primary winding. The addition of a single gain control may easily be added between pins 1 and 3 to reduce gain in order to retain constant output for different supply voltages (see Figure 8) or V_R may be connected to a fixed voltage. (See 'Biasing'.)



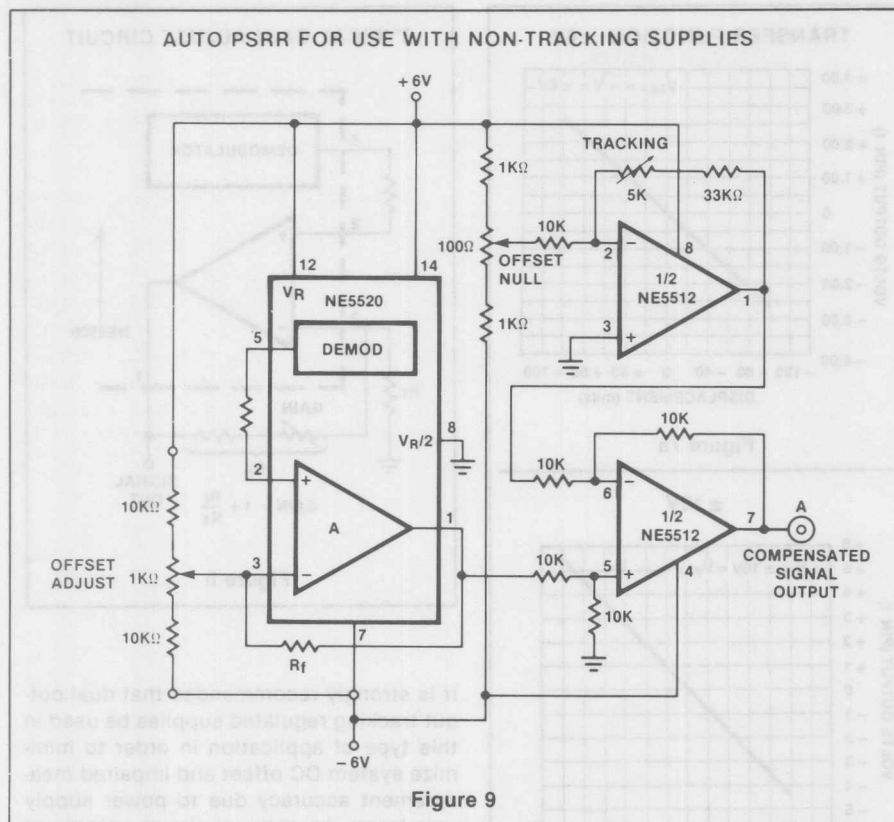
It is strongly recommended that dual output tracking regulated supplies be used in this type of application in order to minimize system DC offset and impaired measurement accuracy due to power supply unbalance. An optional circuit capable of automatically tracking and nulling power supply offset is shown in Figure 9. The bipolar output signal is referenced to ground.



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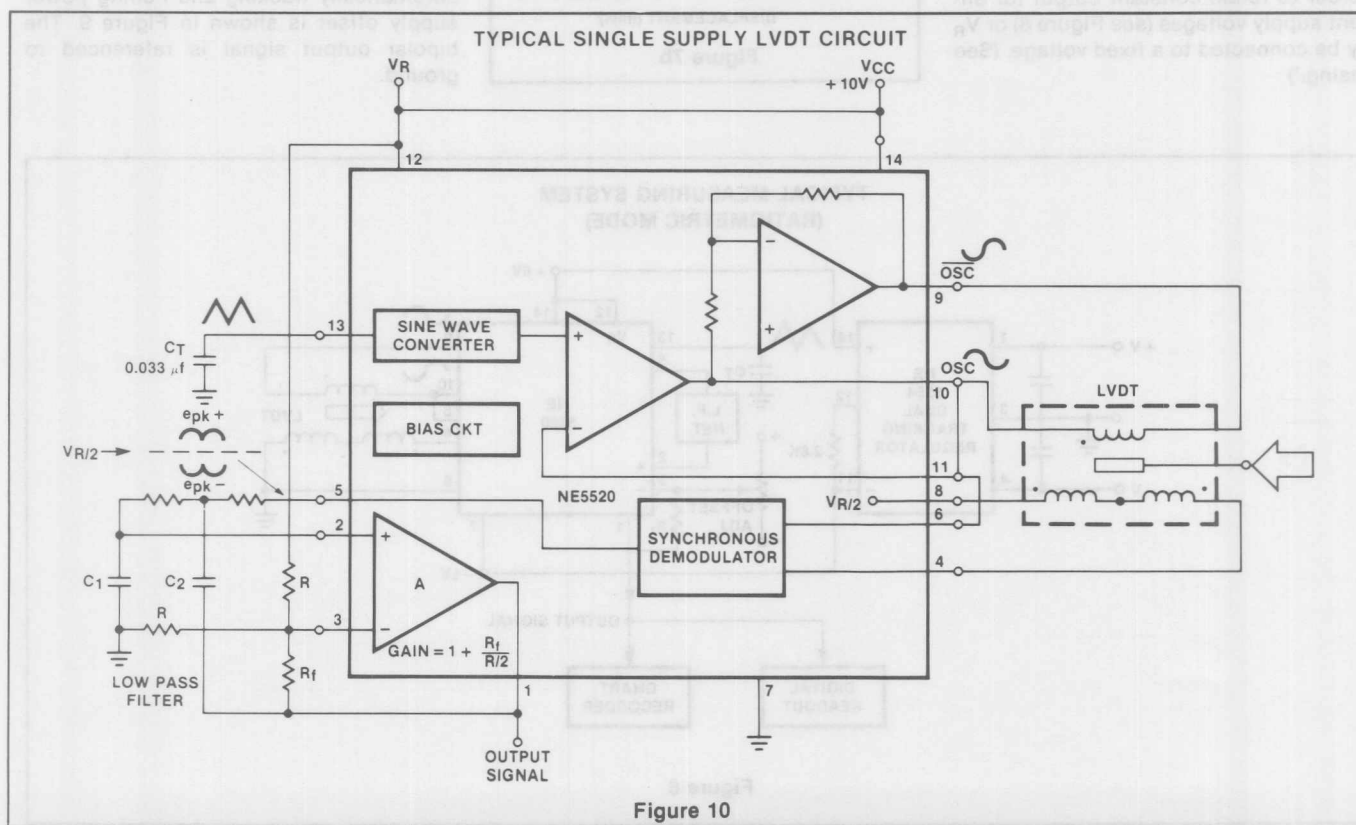
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NULLING PROCEDURE
(Ref Fig. 9)

1. Null transducer position by observing pin 4 waveform. Set supply voltage for ± 6.00 volts.
2. Set offset adjust pot (feeds pin 3 of NE5520) for 0.00 volts and DC at pin 1 of NE5520.
3. Adjust offset null pot (NE5512) for zero output on Terminal A.
4. Check for equal voltage $\pm$ deflection when transducer is displaced equal distances from physical null position.
5. Adjust tracking control for minimum DC output change when either supply is varied over operating range at 'A'.

SINGLE SUPPLY OPERATION

Single ended supply operation requires a different circuit approach to obtain measurement system interface. Figure 10 shows a typical circuit using a single 10-volt supply. Note that the output (pin 1) of the NE5520 is now floating above ground at approximately $V_R/2$. Simple measuring circuits may be realized (Figures 11A, B, C) by placing a DC microammeter between pin 1 and a resistive divider



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creating a bridge readout which is ratio-metric with supply voltage variations. In case more precision is necessary, a buffer amplifier may be added between the voltage divider or $V_R/2$ and the readout circuit in order to minimize offset due to measuring circuit loading. DC offset due to internal tracking error in the NE5520 may be reduced by using the nulling circuit shown in Figure 12. Offset sensitivity and its effect on system accuracy will be inversely proportional to full scale signal output of the NE5520 which is a function of the DC gain of the auxiliary amplifier and LVDT output. A typical full scale output with 10-volt supply operation is $V_R/2 \pm 3.5$ volts with gain equal to 10.

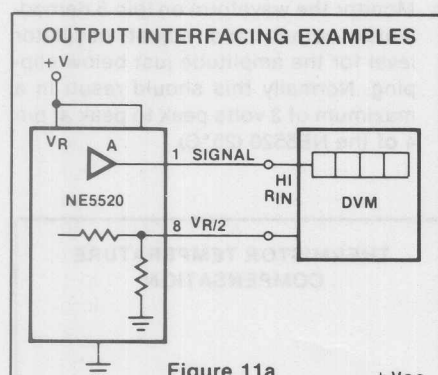


Figure 11a

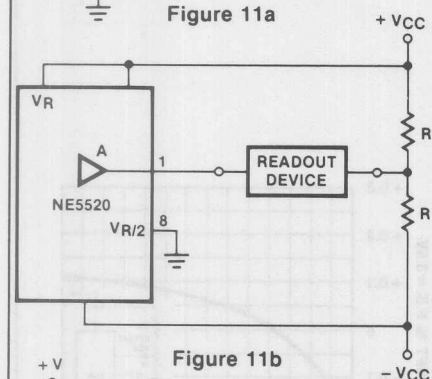


Figure 11b

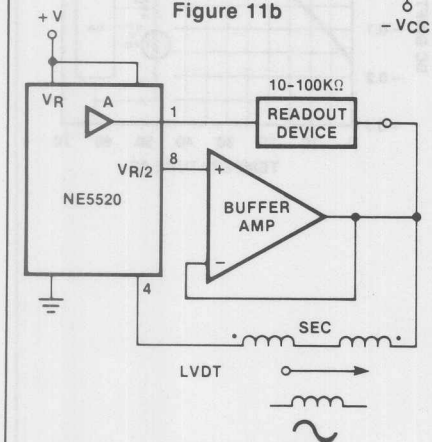


Figure 11c

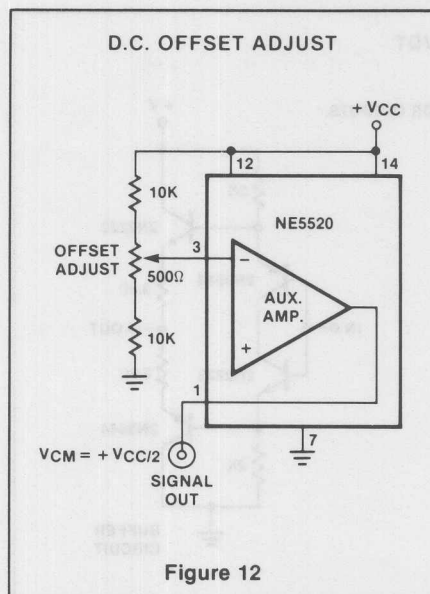


Figure 12

MATCHING THE NE/SE5520 TO LOW IMPEDANCE LVDT's

The NE5520 exciter output is capable of driving LVDT primary windings with a minimum impedance of 1K ohm. When a significantly lower impedance primary is driven by the device some form of step-down impedance matching or a power buffer is recommended. Figure 13 shows a step-down matching transformer approach. A transformer with primary impedance of approximately 1K ohm (audio type) with the proper secondary impedance to match the LVDT primary is used to couple

oscillator excitation. Depending on the output efficiency of the LVDT, output signal losses may occur with a corresponding loss in measuring sensitivity. The auxiliary amplifier gain may be increased to offset this loss.

A second approach makes use of a power buffer amplifier constructed from discrete transistors (2N2222, 2N3644). This circuit (Figure 14) results in less signal loss and is inexpensive. A DC decoupling capacitor must be used to prevent DC offset currents from flowing in the LVDT primary winding. A 3dB signal reduction is noted when driving a 15-ohm load to 6 volts peak to peak (10-volt operation); and 12 volts peak to peak for 20-volt supply.

NE5520 TEMPERATURE COMPENSATION

Internal offset voltages originating in the NE5520 synchronous demodulator require external compensation to obtain best measurement accuracy when operating over the full temperature range. The circuits shown (Figures 15A, B) give a simple approach using a thermistor inserted in series with the offset null resistors to reduce voltage drift to a reasonable level. These tolerances are based on ± 3.5 volts full scale output for LVDT displacements each side of physical null. A thermistor having a positive coefficient of $+0.7\%/^{\circ}\text{C}$ is used. Obviously, if the total divider resistance is changed a different thermistor resistance will be required.

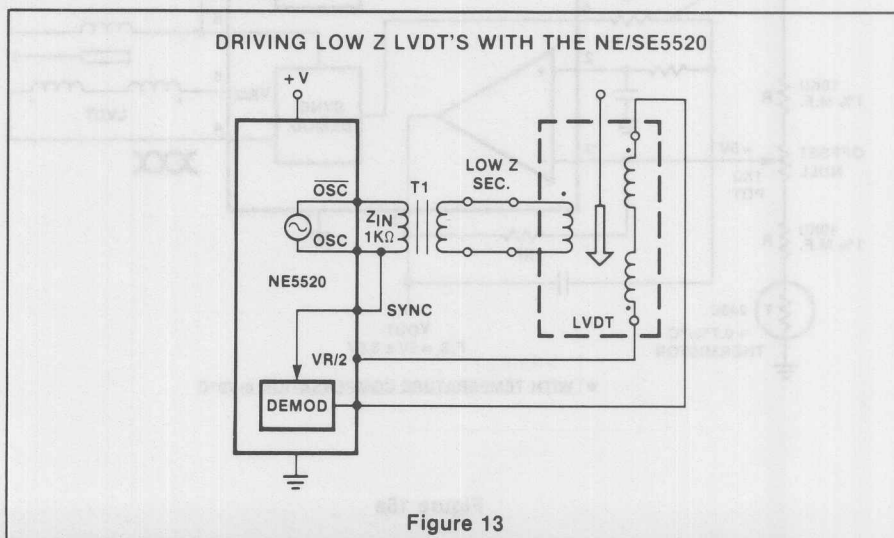
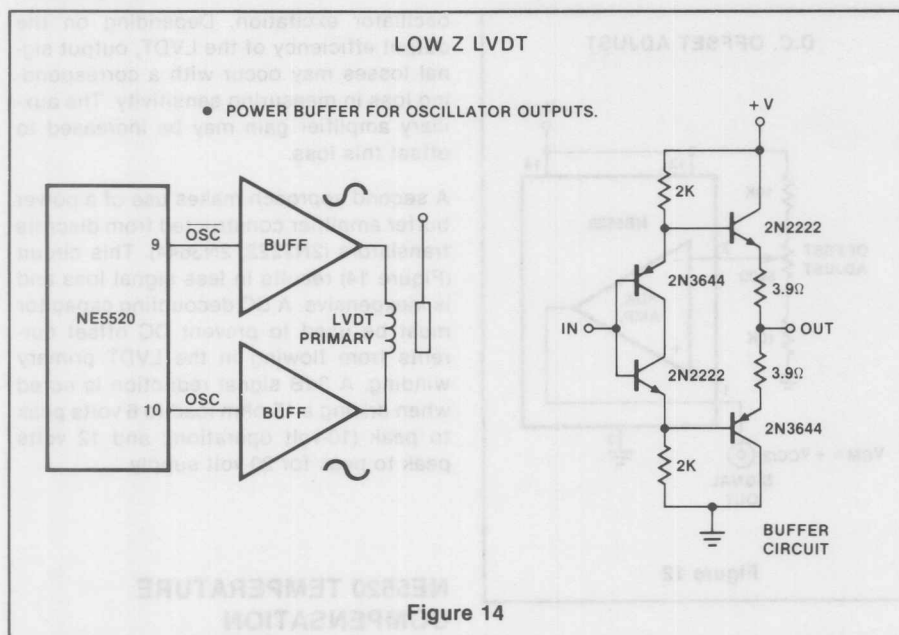


Figure 13

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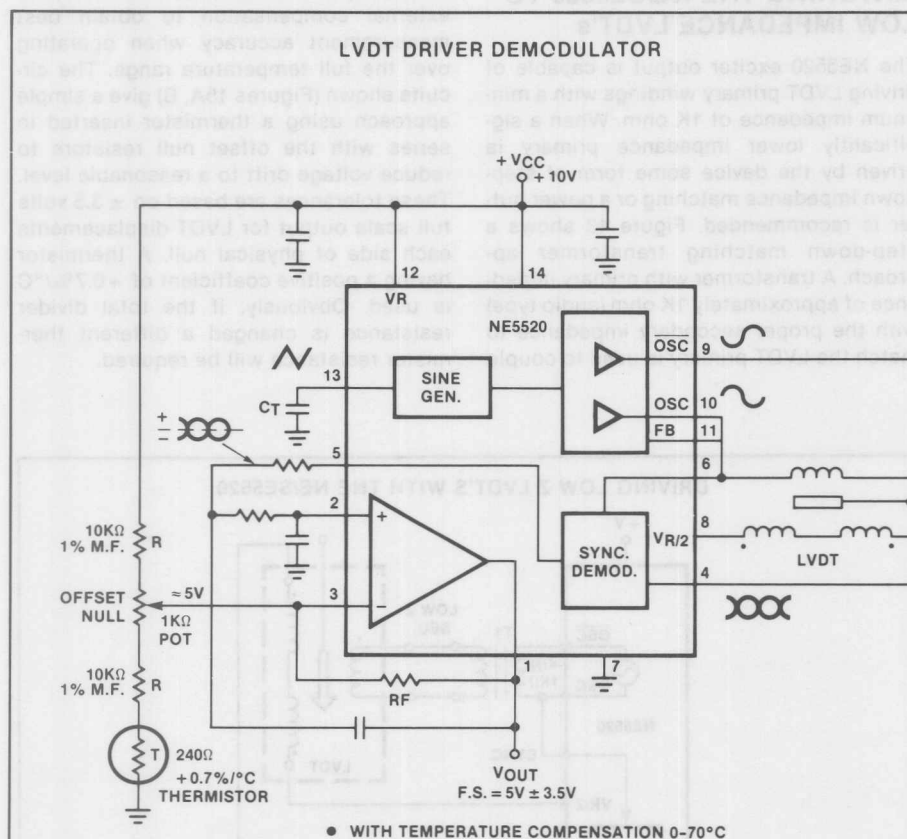


DEMODULATOR DISTORTION (OVERDRIVE)

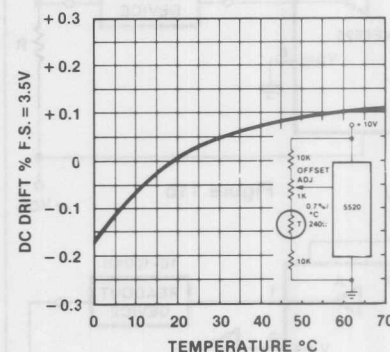
When the demodulator input exceeds 2 volts peak to peak clipping distortion will increase and must be avoided by controlling oscillator drive to the primary of the LVDT. Figure 16 shows an example of a circuit for attenuating primary excitation using a 1K ohm potentiometer.

The procedure for adjusting the level is simply to:

1. Set LVDT core position for maximum output from the secondary.
2. Monitor the waveform on (pin 5 demodulator output) and adjust oscillator level for the amplitude just below clipping. Normally this should result in a maximum of 2 volts peak to peak at pin 4 of the NE5520 (25°C).



THERMISTOR TEMPERATURE COMPENSATION



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LVDT SECONDARY PHASE ANGLE COMPENSATION BY EXCITATION FREQUENCY

The LVDT has a frequency dependent phase shift associated with the particular characteristics of the device and its excitation frequency. This phase shift is in addition to the 180° shift which occurs when passing through null position.

By adjusting the frequency of the sine wave excitation a condition results which causes secondary voltage to be in phase with primary excitation. The adjustment of relative primary and secondary phase angles has several effects. First, if the primary excitation is referenced to the synchronous demodulator, as in the NE5520, optimum rectification occurs at zero phase differential between secondary AC phase and demodulator switching relative to the waveform zero crossings. Second, "Exciting an LVDT at its zero phase angle frequency results in minimum sensitivity to frequency and temperature variations" (Schaevitz Handbook of Measurement and Control, 1976).

DEMODULATOR SYNC PHASE

A second method of phase compensation of the NE5520 versus the LVDT is to use a variable phase shift network between the oscillator output and the sync input to the NE5520. This is shown in Figure 17. The oscillator frequency remains fixed and the pot is tuned for optimum demodulator phasing.

It is emphasized that an external phasing adjustment as outlined above is not always necessary. Some LVDT's operating in the 1-5kHz range will be near zero phase and will need no phase compensation. Experimental evaluation of the prototype design combined with system specifications will be the best means of making this decision.

Waveform photo in Figure 18A-B, shows the demodulator output signal when phasing of the synchronous demodulator is correct (A) and improperly adjusted (B).

Proper phasing of the sync signal to the demodulator results in optimum sensitivity and linearity.

LIMITING LVDT EXCITATION TO PREVENT DEMODULATOR DISTORTION

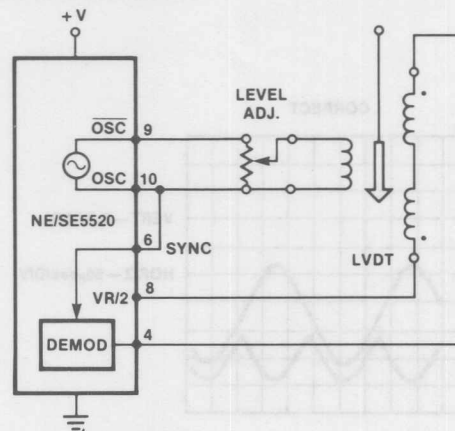


Figure 16

EXTERNAL PHASE ADJUSTMENT

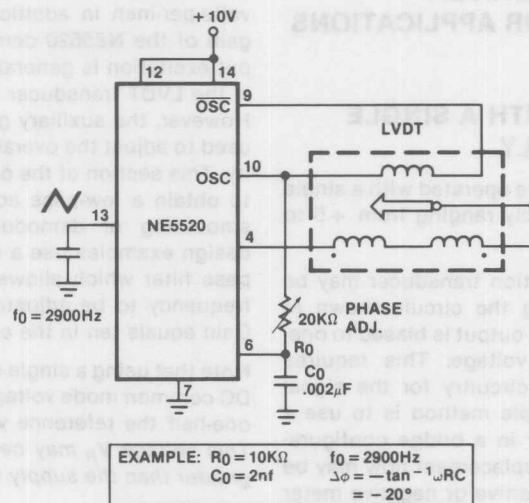


Figure 17

LVDT SIGNAL CONDITIONER

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NE/SE5520 DEMODULATOR PHASING

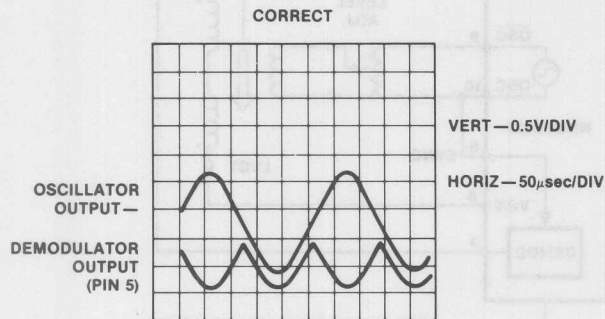


Figure 18a

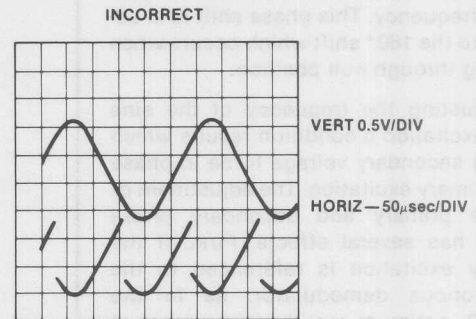


Figure 18b

NE5520 LVDT DRIVER
DEMODULATOR APPLICATIONSOPERATED WITH A SINGLE
POWER SUPPLY

The NE5520 may be operated with a single ended power supply ranging from +5 to 25 volts.

A very simple motion transducer may be constructed using the circuit shown in Figure 19A, B. The output is biased to one-half the supply voltage. This requires special interface circuitry for the signal readout. One simple method is to use a zero center meter in a bridge configuration as shown. Displacement now may be measured as a positive or negative meter reading. Readout sensitivity is a function of the particular LVDT and of the gain of the error amplifier. DC offsets may be nulled by using a simple offset adjustment circuit as indicated.

The transducer is centered in its displacement and the *offset adjust* pot set for a zero meter reading. Once this procedure is completed, the circuit is capable of making measurements based on transducer displacement. Displacement sensitivity is

a function of the LVDT transducer rated in volts-per-inch in addition to the transfer gain of the NE5520 demodulator. The input excitation is generally a fixed level as is the LVDT transducer transformer ratio. However, the auxiliary gain stage may be used to adjust the overall system sensitivity. This section of the device is also used to obtain a low-pass active filter for the smoothing of demodulator ripple. The design examples use a simple VCVS low-pass filter which allows gain and cut-off frequency to be adjusted independently. Gain equals ten in the example.

Note that using a single supply results in a DC common mode voltage at the output of one-half the reference voltage on pin 12. *This voltage V_R may be equal to but not greater than the supply voltage on pin 14.*

LVDT MEASURING CIRCUIT
USING A DUAL SUPPLY

A second mode of operation makes use of dual power supply. A common choice may be ± 5 , ± 6 , or ± 10 volts. Special consideration must be made in properly biasing the internal circuitry to operate under these conditions. Figure 20 shows a simple design for working with ± 6 -volt supplies. Special provisions for minimizing

DC power supply offsets may be made by using the NE5512 dual op amp as a tracking voltage source and difference amplifier-output buffer (see Figure 9). A second method is to use a dual tracking regulator to supply the NE5520.

LVDT IN CLOSED LOOP SERVO

The LVDT provides an excellent method of obtaining position information for closed loop servo drive systems. Pressure rollers, hydraulic drivers, and motor driven linear motion transducers are a few of the general applications which may benefit from the accuracy and speed of response inherent in the LVDT sensor.

A simple block diagram (Figure 21A) shows one possible application in which the NE5520 with LVDT sensor provides accurate position control in a closed loop servo. Linear motion from millimeters to inches of translational motion are possible using the LVDT technique.

In practice the position voltage may be the output of a D/A converter which in turn is activated digitally from a controlling microprocessor. Keyboard information or software commands are translated directly into mechanical motion (Figure 21B).

LVDT SIGNAL CONDITIONER

NE/SE5520

Preliminary

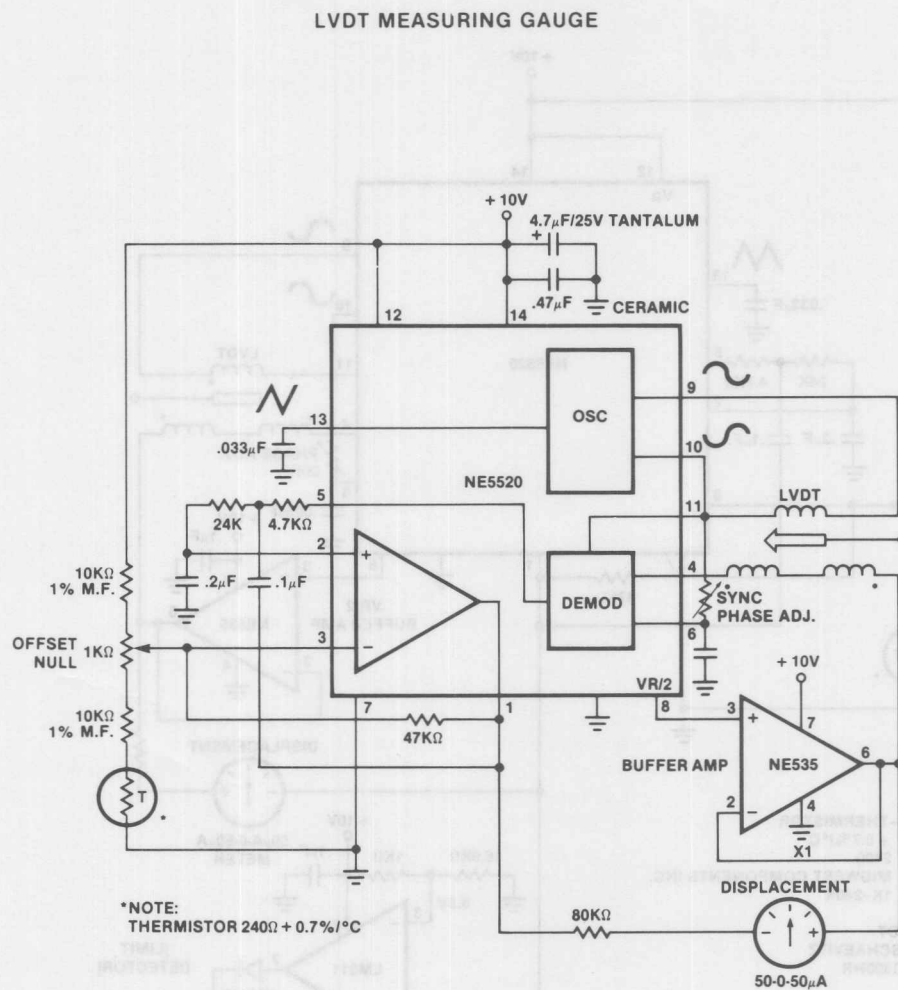


Figure 19a

LVDT SIGNAL CONDITIONER

NE/SE5520

Preliminary

NE5520 LVDT MEASURING CIRCUIT WITH LIMIT DETECTOR

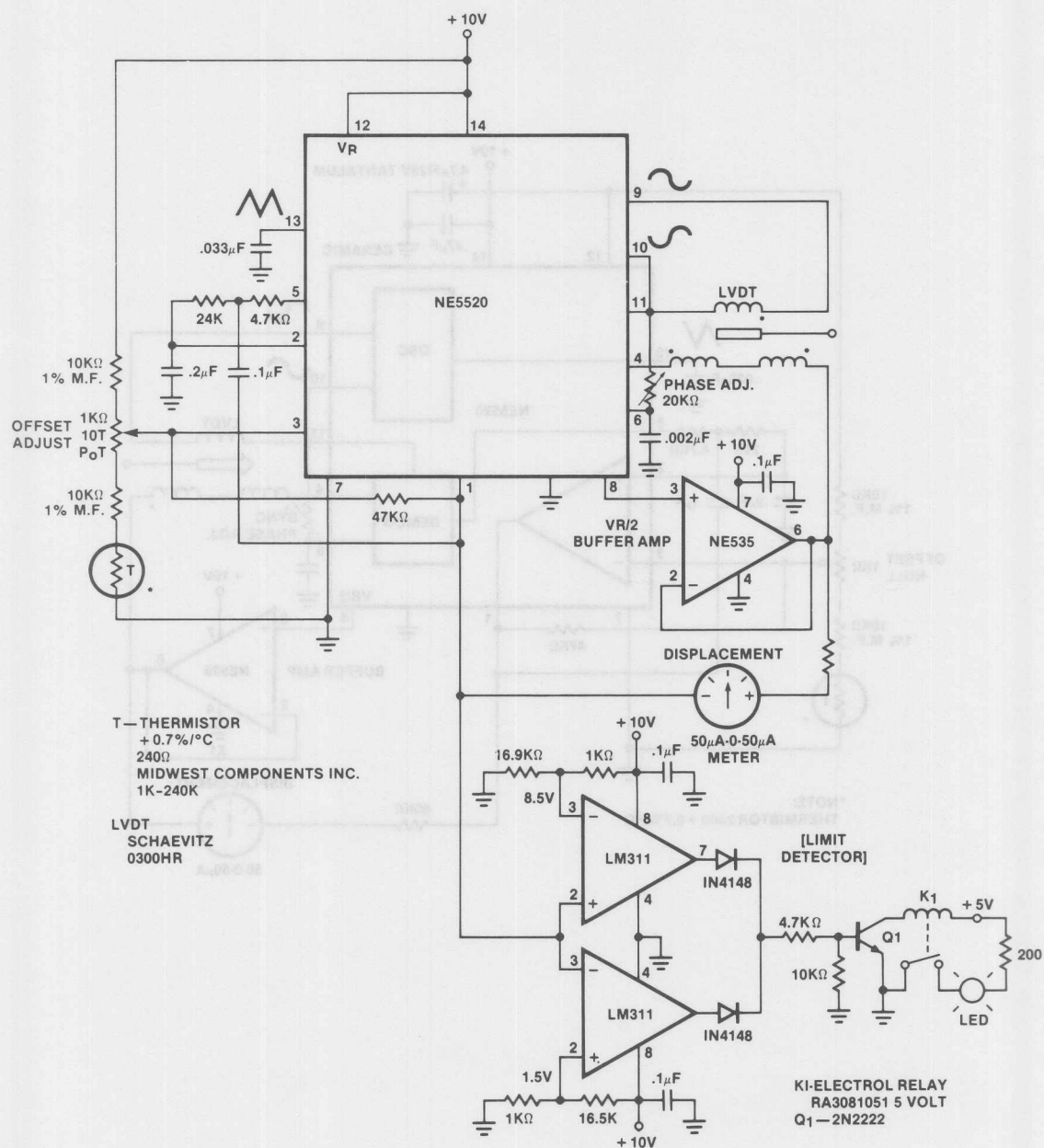


Figure 19b

NE5520 LVDT DRIVER-DEMODULATOR $\langle f_o = 2900\text{Hz} \rangle$

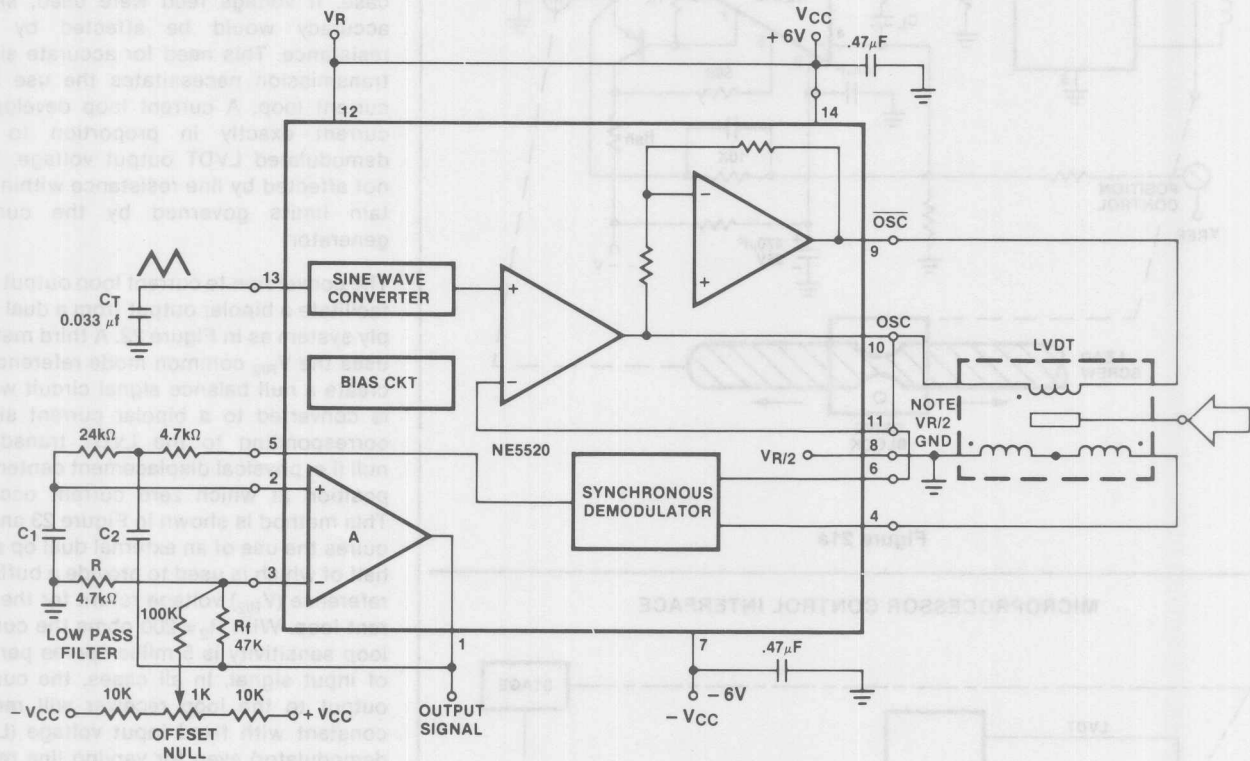


Figure 20

NE5520 POSITION SERVO WITH LVDT SENSOR

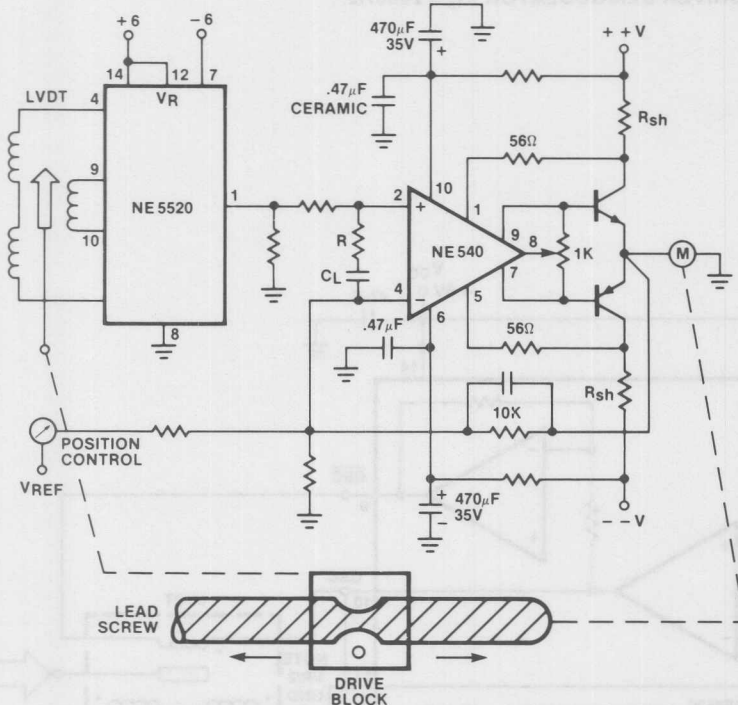


Figure 21a

MICROPROCESSOR CONTROL INTERFACE

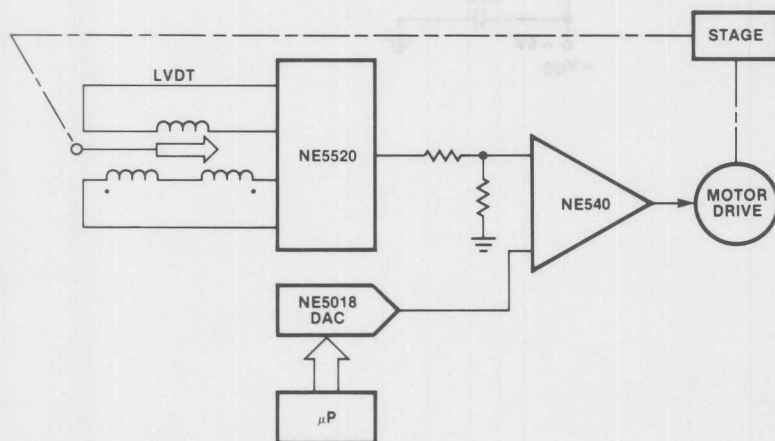


Figure 21b

LVDT SIGNAL TRANSMISSION BY CURRENT LOOP

In certain situations the demodulated output signal must be transmitted over long wires or cables before reaching the signal monitoring equipment. The receiver end may consist of chart recorders, digital panel meters and computers or microprocessors. In some systems many LVDT signals must be monitored from different locations thus requiring variable wire length between transmitter and receiver, thus a different line resistance in each case. If voltage feed were used, signal accuracy would be affected by line resistance. This need for accurate signal transmission necessitates the use of a current loop. A current loop develops a current exactly in proportion to the demodulated LVDT output voltage. It is not affected by line resistance within certain limits governed by the current generator.

The conversion to current loop output may facilitate a bipolar output from a dual supply system as in Figure 22. A third method uses the $V_{R/2}$ common mode reference to create a null balance signal circuit which is converted to a bipolar current signal corresponding to the LVDT transducer null (i.e. physical displacement center null position at which zero current occurs). This method is shown in Figure 23 and requires the use of an external dual op amp, half of which is used to provide a buffered reference ($V_{R/2}$) voltage return for the current loop. With $R_2 = 200$ ohms the current loop sensitivity is 5 milliamperes per volt of input signal. In all cases, the current output to the loop receiver will remain constant with fixed input voltage (LVDT demodulator) even for varying line resistance up to 600 ohms. This resistance must include all wire and load drops in the loop. Various full scale current limits require different supply voltages and without external supplies will be limited by op amp swing characteristics. That is in order to force a given current across $R_L + R_2$ results in an ultimate voltage limit from the op amp output in the current converter as total resistance increases.

A fourth method uses an external supply and discrete transistor controlled by the closed loop op amp referenced to shunt resistor R_{SH} in the emitter return circuit. This of course is a unipolar current loop. See Figure 24.

LVDT SIGNAL CONDITIONER

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Preliminary

NE5520 LVDT SYSTEM WITH BIPOLAR CURRENT LOOP USING NE540 POWER DRIVER

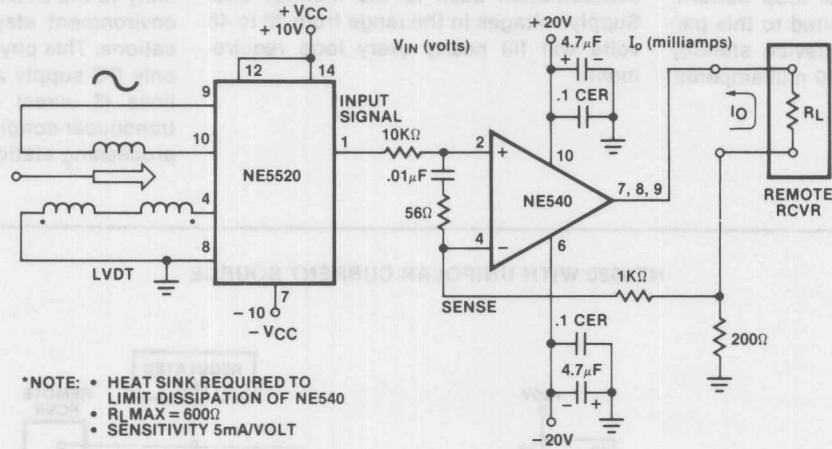


Figure 22

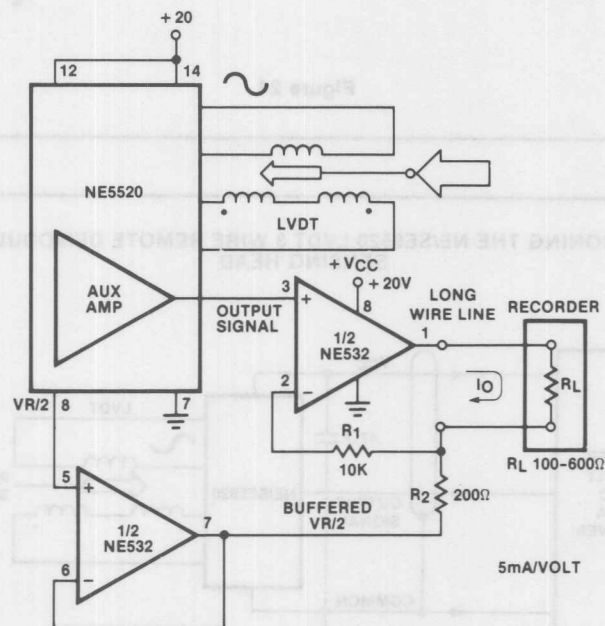
NE5520 WITH BIPOLAR CURRENT LOOP OUTPUT $\pm 10\text{mA F.S.}$ — SINGLE SUPPLY OPERATION

Figure 23

LVDT SIGNAL CONDITIONER

NE/SE5520

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Some systems in common use require two wire source to include both the device operating current and the signal loop current. Thus the quiescent device current must be nulled out at the receiver end leaving the residual signal loop current. The NE5520 is not well suited to this particular design since the device standby current is approximately 10 milliamperes.

A current loop operated from supply voltage sources at the transducer location is a better choice for the operation of an output signal loop where long lines must carry locally generated LVDT signals after demodulation back to the monitor site. Supply voltages in the range from 20 to 48 volts will fill nearly every loop requirement.

POSITIONING THE NE/SE5520 LVDT 3-WIRE REMOTE DRIVER DEMODULATOR SENSING HEAD

The NE5520 may be placed in close proximity to the LVDT transducer provided the environment stays within device specifications. This physical arrangement allows only DC supply and low frequency signal lines (3 wires) being run between the transducer-conditioner unit and the signal processing station as shown in Figure 25.

NE5520 WITH UNIPOLAR CURRENT SOURCE

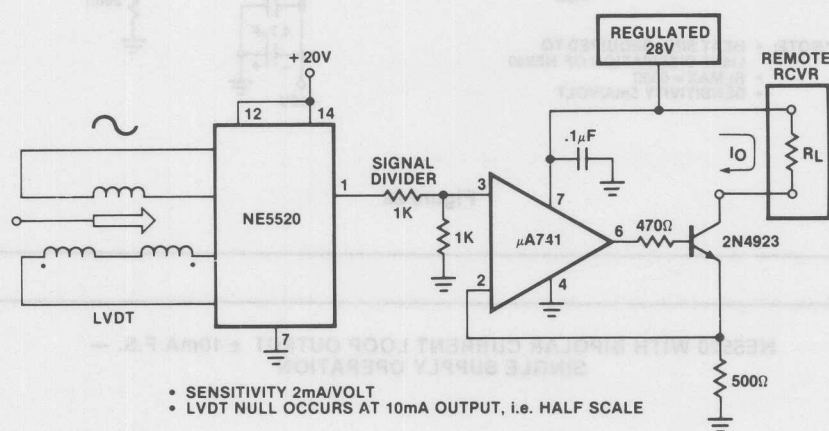


Figure 24

POSITIONING THE NE/SE5520 LVDT 3 WIRE REMOTE DEMODULATOR SENSING HEAD

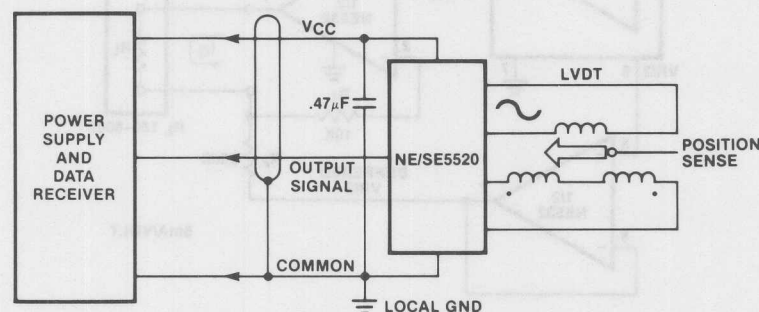


Figure 25

LVDT SIGNAL CONDITIONER

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MULTIPLE TRANSDUCER OPERATION — SYNCHRONOUS OSCILLATOR MODE

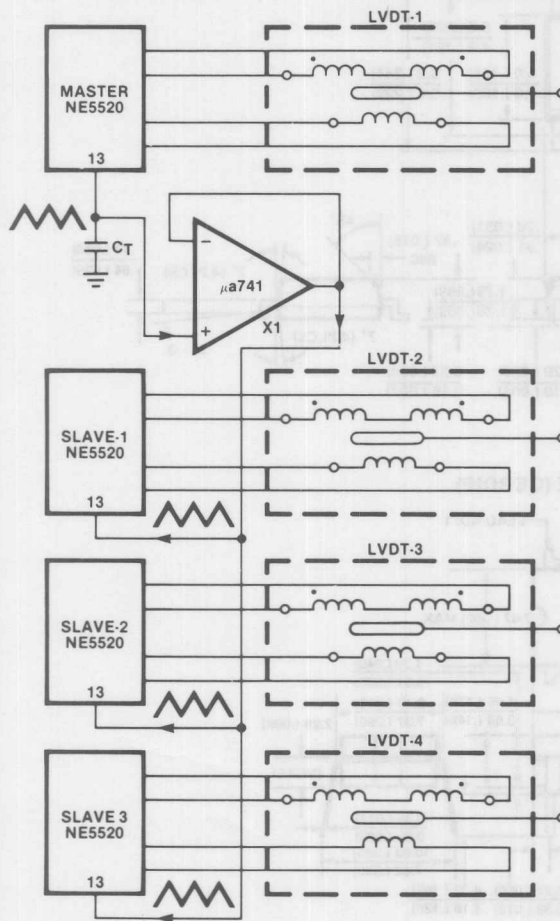


Figure 26

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PACKAGE OUTLINES

